
Space Weather Technical Forecast

Issued on Wednesday, 01 May 2024 at 00:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Further M-flares likely with a slight chance of X-flares through the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is at Moderate levels with an M9.4 flare peaking at 30/2346 UTC, and two further lower M-class flares at 30/0114 UTC, 30/1510 UTC and 30/1630 UTC, all originating from AR3654. There are currently five sunspot regions on the visible disc, though a new region is appearing on the southeast limb and will be added to the list as soon as an analysis can be made. AR3654 in the western disc continues to dominate the flare risk. This region continues to show significant complexity within its intermediate portion in recent imagery and a clear delta spot remaining visible despite the increasingly distorted viewing angle as it moves towards the western limb. Remaining sunspot regions are all significantly smaller and simpler in comparison.

No clearly Earth directed CMEs identified in available imagery over the last 24hrs.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1 initially on a declining trend as the recent High Speed Stream (HSS) eases, with a weak CME arrival at 30/1135 UTC ongoing. Wind speeds initially eased from around 420 km/s to near 380km/s, jumping to 420 km/s after the CME arrived. Density was mostly below average, becoming average to above average and variable following CME arrival. The Interplanetary Magnetic Field was also initially weak, but saw a number of stepwise increases after the CME arrival, reaching a peak of 12nT by the end of the period. The north-south component, Bz, initially weakly positive, saw erratic negative drops following CME arrival, with a minimum of -8/-9nT recorded. Phi angle has been variable. Geomagnetic activity was Quiet to Active (Kp 1-4).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence was well below the Active threshold, with a very slight rising trend. Observed fluence at 01/0001UTC was 9.69e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity likely to continue with further M-flares now considered likely, and a slight chance of X-flares, principally from AR3654.

Solar Wind / Geomagnetic Activity: There are currently two CME featuring in the forecast, the first from 26/1830 UTC appears to be producing the current CME enhancement. The second is associated with an eruption near centre disk approximately 29/0930UTC. Modeling suggest the risk of a glancing blow from this feature sometime during Day 3 (3 May).

Solar winds currently slightly elevated around 400-420km/s and experiencing weak CME effects,

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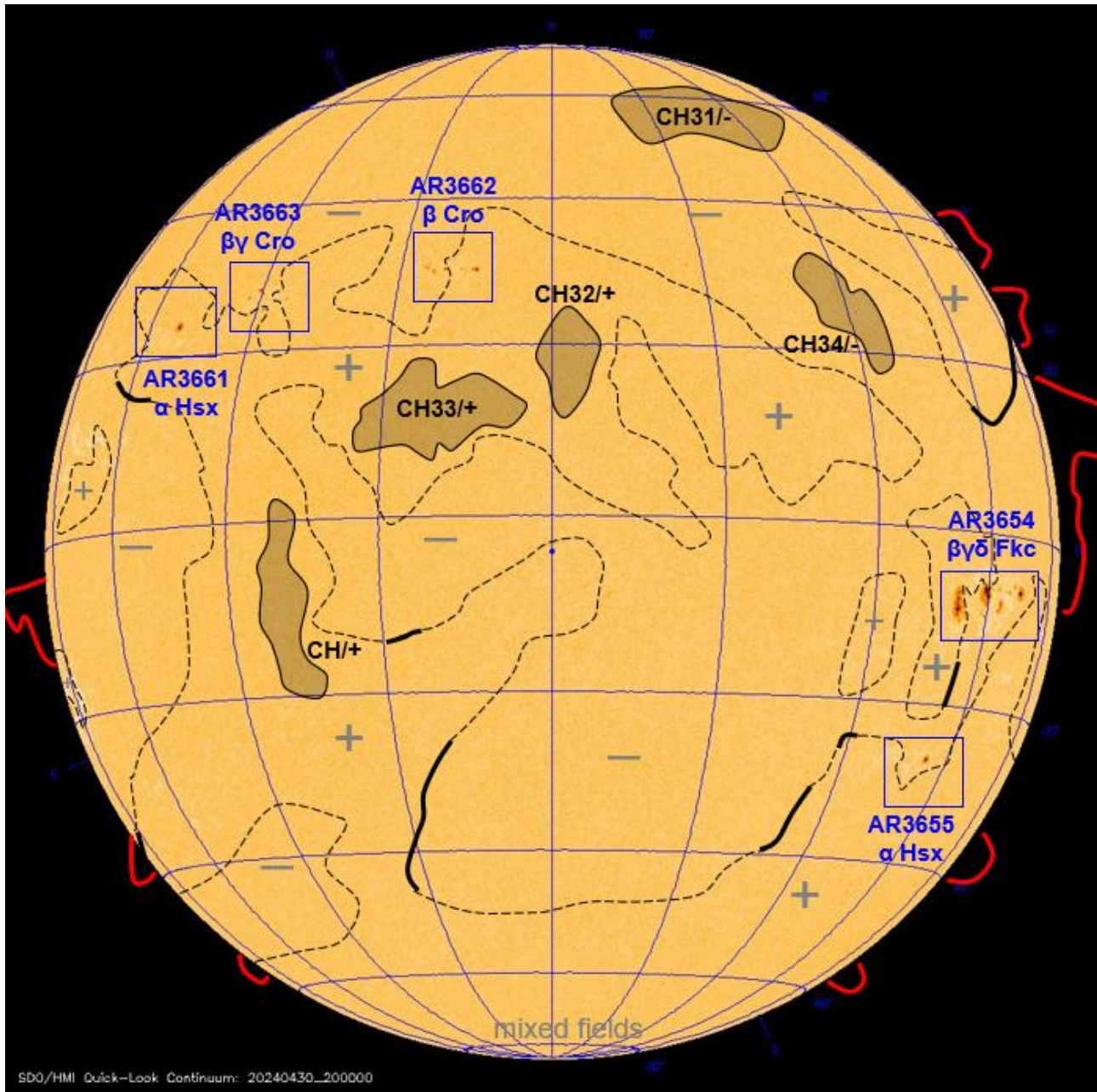
these likely to continue through Day 1 (1 May), with a potential weak HSS connection perhaps bringing elevated wind speeds briefly. Conditions then expected to gradually return towards background through Days 2 and 3 (2-3 May). Further HSS influence may see another increase in wind speeds back to elevated levels later on Day 3 into Day 4 (3-4 May).

Geomagnetic activity is expected to be generally Quiet to Unsettled, but Active intervals likely at times under weak CME influence and potential HSS arrivals, with a slight chance of a G1/Minor storm interval throughout.

Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at background levels through this period. There is a slight chance for an S1 or greater event, with AR3654 posing the main risk as it continues to rotate westwards.

High energy electron flux likely remaining at background to moderate levels, with the associated fluence expected to remain below the Active ($1e8$ integrated pfu) threshold throughout.

Figure 1. Solar Analysis Valid 30/2000UTC.



Key: Filament --- , Prominence --- , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are currently two CME featuring in the forecast, the first from 26/1830 UTC emerged from an area of plage in the southeast of the disc, likely associated with a filament eruption. This appears to be producing the current CME enhancement. The second is associated with an eruption near centre disk approximately 29/0930UTC seen deflecting north and westwards in AIA-304 imagery. Modeling suggest the risk of a glancing blow from this feature sometime during Day 3 (3 May).

Solar winds currently slightly elevated around 400-420km/s and experiencing weak CME effects, these likely to continue through Day 1 (1 May), with a potential connection from the recently re-numbered coronal hole CH34/-, perhaps bringing elevated wind speeds briefly. Conditions then expected to gradually return towards background through Days 2 and 3 (2-3 May). CH32-33/+ approaching centre disk in the northern hemisphere may see another increase in wind speeds back to elevated levels later on Day 3 into Day 4 (3-4 May).

Geomagnetic activity is expected to be generally Quiet to Unsettled, but Active intervals likely at times under weak CME influence and potential HSS arrivals, with a slight chance of a G1/Minor storm interval throughout.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/2250	Partial	Plage	Centre-southern disk	450 km/s	03/2000UTC	Low confidence glancing blow

Figure 2: Latest 24hr ACE Magnetometer trace showing complex and multipart but generally weak CME arrival



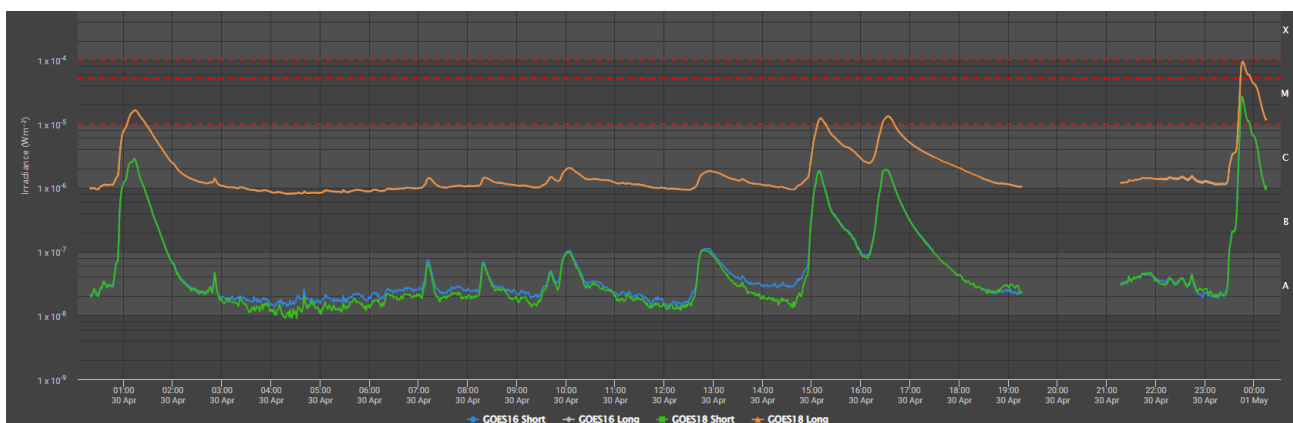
Radio Blackouts - X-Ray Flares:

AR3654 in the western disc continues to dominate the flare risk. The evolution of this region looks to have slowed but it continues to show significant complexity within its intermediate portion in recent imagery, and a clear delta spot remains visible despite the increasingly distorted viewing angle as it moves towards the western limb. Whilst this region has so far only been responsible for low level M-flares, an apparent increase in magnetic flux in recent days brings perhaps a slightly increased risk compared to previously of an X-flare from this region. Remaining sunspot regions are all significantly smaller and simpler in comparison, with a new region appearing on the southeast limb.

Limited signals in far-side helioseismographs for any significant oncoming regions, but some smaller retuning regions are expected into the period. These may help to bolster the flare risk later in the period as AR3654 is due to rotate off the visible disk on Day 3 (03 May), with the flare risk associated with this region perhaps starting to slowly reduce later on Day 4. Overall, further M-flares now considered likely given recent activity, with a slight chance of X-flares, principally from AR3654.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	70	60
Very Active	R3 to R5 X Class	No	15	15	15	10

Figure 3: Latest 24hr GOES16/18 X-ray trace showing most recent M9.4 flare from AR3654, for which we await any proton response or CME signature.



Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. There is a slight chance for an S1 or greater event however, should there be any large flares from AR3654 as it continues to rotate westwards, with the risk persisting into Day 4 (4 May) despite AR3654 rotating over the limb.

Radiation Storms	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	15	15	15	15
Very Active	$\geq \text{S3}$ *	No	1	1	1	1
* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. ($\text{pfu} = \text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)						

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux has been mostly at background levels, just touching moderate at the diurnal peak. The recent HSS influence was weak enough that no significant increase in electron flux is expected from this. During Day 1 (01 May) some portion of the newly renamed CH34/- may become geoeffective, perhaps bringing elevated wind speeds, although this will most probably only be for a brief period. As such, no significant increase in electron flux is expected from this feature, although counts may reach moderate levels at the diurnal maxima. A further HSS from CH32/+ is possible near the end of this period, which could reduce any flux increase once again.

Overall, the 24 hour integrated electron fluence is most likely to remain below the Active ($1\text{e}8$ integrated pfu) threshold, perhaps with a very slight rising trend in the latter half of the period. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	5	1
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM output

